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May 16, 1978

National Aeronautics & Space Administration
George C. Marshall Space Flight Center
Marshall Space Flight Center

Attention: Mr. James H. Ehl, Chief
Tooling Applications Branch
Materials and Processes Laboratory (EH44)

Subject: Manufacturing Process Applications Team
(MATEam), Contract No. NAS8-32229,
Quarterly Status Report No. 1
for February 1, 1978 through April 30, 1978

Gentlemen:

INTRODUCTION

This is the first quarterly report for the 1978 MATEam program. During the past three months team activity has been involved in several areas which include the development of technology transfer goals and milestones for the program year, the identification of candidate RTOP programs, concentration of effort on high potential and potential technology transfers, and the continued identification of manufacturing problem/opportunity statements.

Technology has been transferred in the form of a flux used in the stud welding of aluminum. Progress in the dissemination of the technology to other sectors of the welding industry has commenced.

TECHNICAL PROGRESS

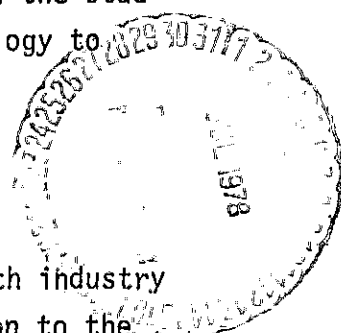
Industry Contacts

The MATEam has maintained a consistent communication link with industry in the identification of problem/opportunity statements in addition to the evaluation and assessment of potential problem solving NASA technology. Industry continues to show a high degree of interest in the program. There has been a total of (78) contacts with new companies. There has been a total of (9) presentations given related to the MATEam program to key society organizations, and companies that are considered to be leaders in a

(NASA-CR-150725) MANUFACTURING PROCESS
APPLICATIONS TEAM (MATEAM) Quarterly Status
Report, 1 Feb. - 30 Apr. 1978 (IIT Research
Inst.) 31 p HC A03/MF A01 CSCI 22A

G3/12 21627 Unclass

N78-25114



specific industry. Those industries contacted represent the aircraft engine, shipbuilding, lead and zinc industry, metals, copper, battery, welding, and the off the road equipment industry. The organizations visited are listed in Enclosure 1.

MATeam presentations were given at the NASA Langley Technology Utilization Office and the NASA Fifteenth Space Congress describing the MATeam purpose and program progress to date.

All of the societies and trade organizations visited expressed an interest in participating in the MATeam program along with their member companies.

Two presentations are particularly noteworthy. As a result of the presentation, International Harvester Co. has organized a committee to identify and prepare problem/opportunity statements related to significant manufacturing problems. The MATeam has received a total of five (5) statements from the committee thus far. The presentation to the American Society for Metals (A.S.M.) was to describe the purpose and operation of the MATeam and to develop a system that will enable the transfer of manufacturing related metallurgical engineering data identified by the MATeam contained in NASA Engineering reports. The selected technology would then be published in an A.S.M. "Source Book" which is devoted to a specific manufacturing technology. As a result of the meeting, A.S.M. has identified seven(7) problem/opportunity statements in which technology is needed. In addition, they have agreed to publish the related technology identified by MATeam in "Metals Abstracts" (a monthly publication) as well as the "Source Book" to member individuals and companies.

Research and Technology Objectives and Plans (RTOP) Activities

There has been a total of five (5) RTOP's that have been identified as candidate programs, the majority of which are considered to have a strong impact potential in the industry in which they will be applied (Enclosure 2).

MAT - 86 The Weld Skate. The RTOP was approved for funding during the three month reporting period and does not appear in Enclosure 2. It is anticipated that the two-year NASA/Chemetron Corporation program will start

during the second reporting period. The program is designed to commercialize the welding system for application to the shipbuilding and pressure vessel industries.

MAT - 16 The Concentration of Waste Heat Recovered from Stack Gas or Waste Water. The problem originated in the textile industry with a major textile manufacturer. Considerable heat is lost in the operation of textile drying ovens and the discharge of heated process water. The intent is to adapt NASA (Tech Brief 71-10109) developed heat pipe technology to making efficient use of heat in the textile industry. A joint NASA/industry funded program is being planned.

MAT - 54 The non destructive Testing of Spotwelds. The automotive and aircraft industries do not have a quantitative non-destructive test process for determining the quality of spot welds. They presently use costly destructive test techniques. The availability of a system that can be used in production can have a pronounced influence in reducing inspection costs. A portable ultrasonic device has been developed at the Marshall Space Flight Center (Tech Brief 66-10289) and is presently being studied by major users and non-destructive equipment manufacturers. There is a possibility that industrial (i.e. Krautkramer) and other federal agencies (i.e. WPAL) funding can be made available to help support the RTOP program.

MAT - 71 Computer Aided Design for Sand Casting Molds. The use of computer programs to aid in the design of sand casting molds is a technology that has stimulated significant interest in the casting industry. The use of the NASA computer programs (Tech Brief B72-10736 and MCS-13805) will improve casting quality and cost savings which will be realized in reduced scrap rates. MATeam activities will start in June in establishing contacts with major users.

MAT - 82 Automatic Laser Inspection of Printed Circuit Boards. A prototype test device has been partially developed under NASA contract (NASA-CR-123530) which will enable inspection of the soldered joints on the under side of printed circuit boards. Present inspection techniques require that each soldered joint be inspected visually. The MATeam is establishing the present capability of

the developed system, and further assessment of its impact in reduction of inspection costs. Contacts have been started with user companies (Honeywell) and initial interest is high. Contacts with major inspection equipment manufacturers (Automation Industries) are in progress.

MAT - 105 In-Process Technique for Balancing Drive Shafts. A computer operated laser balancing system has been developed by NASA (Lewis) (Tech Brief 76-10452) which rapidly and accurately balances drive shafts by vaporizing areas on the shaft identified as causing the out of balance. A major user (Bell Helicopter) is interested in the device and has expressed interest in purchasing a system. The MATEam has been working with the tech center and a potential system manufacturer (IR & D CO.). The specific reasons in needing RTOP funding has not been identified at this stage of activities.

MAT - 117 Sialon Cutting Tool Material. The candidate, RTOP, has been deleted from Revision B of Enclosure 2 and will be processed as a direct transfer.

MAT - 118 Protective Coating for Die Casting Dies. The die coating program has been deleted from the program due to the high cost associated with application of the coating. It has been determined by the Die Casting Institute that the cost of coating is not economically feasible due to the low cost of the core pin.

Identification of Problem/Opportunities

Upon completion of the 1977 MATEam program year there was a total of 150 problem/opportunity statements identified. A total of 40 additional statements have been prepared during the first quarter of the 1978 program year. The new problem/opportunity statements have been added to the list, Enclosure 5.

Enclosure 3 includes selected problem/opportunity statements that are considered to have a high potential for transfer in the 1978 program year and are presented in the form of goals and milestones.

Enclosure 4 includes the updated listing of the 20 problem/opportunity statements considered to be potential technology transfers. Those statements that appear on the program goals and milestones have been removed from the potential transfer list and replaced with the following:

MAT - 115 - Contingency Planning for Hazardous Environments

MAT - 141 - Improved Arc Shield Material

MAT - 160 - Heat Pipes in Truck Cab Heating

MAT - 183 - Oven or Furnace Temperature Measurement Using
Telemetry

MAT - 190 - Metallurgical Data Related to High Temperature
Super Alloys

Technology Transfers and High Potential Transfer Status

The first MATEam technology transfer involved the transition of the aluminum stud welding flux "Aquet". Details pertaining to the technology transfer and the status of high potential transfers is discussed below.

MAT 80 - Improved Flux for Stud Welding of Aluminum (AQUET)

The Tru-Weld Division of Tru-Fit Products Corporation (Medina, OH) has evaluated the flux and are pleased with the fine quality it produces in the final weld. Tru-Weld are producers of stud welding equipment. They are presently recommending the flux to their customers involved in the stud welding of aluminum. They are presently evaluating the flux on different aluminum alloys to expand its application.

Two organizations have been contacted by the MATEam and are being considered potential marketing sources for the fluxing agent. Coordinated Industries (Pittsburgh, PA) and KSM Fastening Systems Division (Morriston, NJ) are presently reviewing the capabilities of the flux and its market potential.

MAT 100 - High Temperature Plastic for Food Processing

The manufacturer of food processing equipment, Transtherm, Ltd., continues to evaluate the NASA (Lewis) polyamide material for application to his energy saving heated cover design. Earlier studies have shown that food can be heated more efficiently with a bowl or plate cover containing a heating element. In an effort to select a plastic material that is biocompatible and will perform effectively with thermal cycling, the NASA plastic along with others is being evaluated.

Recent test results indicate that other commercially available plastic may be as good as the NASA material, biocompatibility testing continues.

MAT 19 - Power Factor Control System

The MATEam has been in contact with the Delco Division (GMC), Emerson Electric, Square D Company, the Packaging Corporation of America, and the Barber-Coleman Electric Motor Division regarding the A-C Fractional Horsepower Induction Motor Control. A review of the technology involved in the control is being reviewed by upper level engineering management of the companies. The Delco Division does not manufacture the fractional level motors; they are purchased from Emerson Electric. The Square D. Company is not interested in the Control at this time. There is continued interest on the part of Emerson Electric, Barber-Coleman and the Packaging Corporation of America.

It is anticipated that a final decision on the level of their interest will be made in May.

MAT 168 - Precision Tube Flaring System

The Valve and Fittings Division of Gould Inc. are presently reviewing the engineering capabilities and market potential of the orbital tube flaring system. The device appeals to the Division since they are presently studying a potential market in high pressure fittings.

The MATEam is in frequent contact with the Program Project Engineer and will plan a demonstration of the NASA Orbital System at MSPC when it is appropriate.

MAT 166 - The Transfer of Miscellaneous Metallurgical Test Data to Industry

The American Society for Metals has notified the MATEam of several manufacturing technology areas in which technology is needed by industry. The areas identified include advanced non-destructive testing techniques for weldments, metalworking technology (ex., forging, deep drawing) high temperature super alloys, cobalt base alloys and others. Since only selected areas of the technology are needed, the MATEam specialists in the technology of interest will work with A.S.M. technical committees to identify selected technology of immediate value.

MAT 167 - The Recycling of Painting Process Wash Water for Industrial Applications and Ecological Compatibility

The problem of recycling wash water and the ability to maintain process water effluent at a chemistry that is ecologically compatible is a potential problem that has been identified by manufacturers using painting processes in addition to the textile industry.

NASA technology which has been limited to reverse osmosis systems does not provide the complex technology required to resolve the potential problems. The MATEam with the Tech Center will determine if there is sufficient NASA technology to indicate an RTOP program.

MAT 152 - Flame Resistant Elastomeric Coatings

Manufacturers of flame resistant coatings make no guarantee as to the life of a flame retardant coating after it is applied to a material. Further, commercially available coatings when applied to fabrics have a negative effect on the material's texture and appearance.

Burlington Industries and Z. Rosan, Inc. are interested in NASA fire retardant coatings that may have improved life and may have potential application to cotton. The elastomeric coating developed by Arthur D. Little under contract to NASA is of interest, in addition to the flame retardant coating development activity for cotton presently under way at the Johnson Space Flight Center.

MAT 154 - Non-Destructive Testing Spot Welds

A NASA developed (Tech Brief 66-10289) portable ultrasonic test device has been identified as a potential solution to the non-destructive inspection of spot welds. At present there are no systems commercially available that have the capability to quantitatively analyze the spot weld. A search for commercially available technology is presently in progress to reject or substantiate this initial analysis.

The test device in addition to other NASA non-destructive test equipment is being reviewed by the first of several non-destructive test equipment manufacturers who will be contacted in the program.

MAT 187 - Low Intensity Portable X-Ray Device (LIXISCOPE)

Ni-Tec Inc., a manufacturer of non-destructive test equipment, has expressed interest in the LIXIScope since they presently have a program defined to build a similar device.

As of mid-March, Ni-Tec Inc. (F. Fender) was in contact with the NASA patent counsel in regards to the LIXIScope.

Presently, Fender is in contact with Mr. Dick Orrick, Deputy Chief of Applications Marketing, NASA Technology Utilization Office, to discuss the LIXIScope with respect to its potential in the industrial market.

The industrial market is seen to benefit from the LIXIScope due to the portability of this device. It will be used primarily as a spot-check device for bond integrity in thin sheet stock by quality control personnel.

MAT 71 - Computer Aided Design of Sand Casting Molds

There is no progress to report during this quarter on MAT 71 since program activity is not scheduled to start until June and the major portion of effort is not scheduled until the last quarter of the year.

Organizational Changes

Mr. John D. Meyer has left IITRI and has joined Lester B. Knight & Associates, Inc., (Chicago, IL) as Managing Associate. It is anticipated that he will be retained as a consultant to the program. Mr. Edmund R. Bangs is the new Director of the MATEam.

The new manager of the Technology Transfer and Market Analysis Section of which MATEam is a part is Mr. Robert Levi, formerly with Borg Warner Corporation. The new organization structure is shown in Enclosure 7.

Future Plans

Presentations

Three presentations to industrial associations are scheduled during the next three-month reporting period. They include the American Society for Non-Destructive Testing, Machine Tool Forum, and Maritime Administration, Enclosure 1.

Company Contacts

MATEam members will continue to maintain a good communication link with industry and will continue to contact companies on a daily basis during the next reporting period. Selected companies considered to maintain a key position in their industry will be visited for on-site presentations and problem discussions.

Definition of Problems and RTOP Activities

It appears at this stage of program growth that the MATEam can process a maximum of 120 problem/opportunity statements. Problem/opportunity statements will be added to the listing to maintain an active range of 120-150 statements. It is anticipated that press releases planned in announcing the "Aquet" transition and the initiation of the Weld Skate RTOP activity will aid team members in identifying new problems with high visibility and significant industry impact.

In the identification of candidate RTOP programs, strong emphasis will be placed on determining the level of common interest the problem has with other federal agencies. In candidate RTOP programs in which other federal agency

interest is strong, the agency will be evaluated as a co-funding source for the RTOP. Ideally, a MATEam goal will be to aid in identifying co-funding sources in the form of federal agencies and industrial organizations.

The MATEam will continue to screen the manufacturing development programs of the Department of Defense, Maritime Administration, National Bureau of Standards and other federal agencies to identify manufacturing problem areas of common interest.

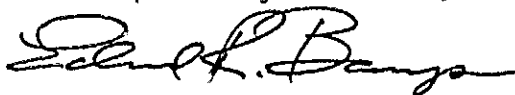
Problem Assessment and Solution Implementation

Program activities will continue to concentrate in the next quarter on the collection of new problem statements in addition to the assessment of existing problem statements. Priority will be directed towards potential RTOP related problem statements and direct technology transfers.

Summary

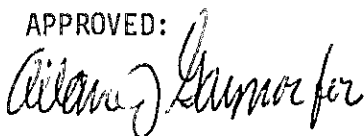
The MATEam screening and assessment of problem/opportunity statements is operating effectively as a means of identifying major industry problems. It is anticipated that with careful application of team efforts to high visibility problems and group founded RTOP programs, the goals for the year will be achieved. The results of the MATEam activities are summarized in Enclosure 6. No major problems have been encountered and program expenditures are within budget.

Respectfully submitted,



Edmund R. Bangs
Director
Manufacturing Applications Team

APPROVED:



Dr. Irvine Solomon
Director of Research
Chemistry and Chemical Engineering
Research Division

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Medical Technology and Systems/Dr. Houston

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MATEAM PRESENTATIONS

February 21, 1978	International Harvester Co. Manufacturing Process Development Group Hinsdale, IL
March 21, 1978	American Welding Society (Chapter) Hartford, CT Audience-Aircraft Engine and Shipbuilding
March 24, 1978	Copper Development Association New York City, NY
March 28, 1978	Wilson Greatbach LTD. Leading Micro-Battery Manufacturer Clarence, NY
April 17, 1978	International Lead-Zinc Research Organization New York City, NY
April 18, 1978	Caterpillar Tractor Company East Peoria, IL
April 26, 1978	American Society for Metals Metals Park, Ohio
April 27, 1978	Fifteenth Space Congress (NASA) Cocoa Beach, FL
May 2, 1978	Raytheon Company Waltham, MA
May 26, 1978*	American Society for Non-Destructive Testing Chicago, Ill.
June 14, 1978*	Machine Tool Forum Pittsburgh, Pa.
June 28, 1978*	Maritime Administration (REAPS) Shipbuilding Conf. St. Louis, Mo.

* Planned

(Revision A) 4/11/78

(Revision B) 5/15/78

MATEAM PROGRAM RTOP CANDIDATES
1978 FORECAST

MAT NO.	TITLE	OBJECTIVES	TIME PERIOD	EST. COST (\$)	NEW TECH/ MARKET EVAL. COMPL. DATE	TECH CENTER
16	The Concentration of Waste Heat Recovered from Stack Gas/or Waste Water	Design modifications to meet safety standards, market cost competition, and improved marketability END POINT-System ready for release to market	18 mos.	\$150,000		Pasadena Ames
54	Non-Destructive Testing of Spot Welds	Laboratory testing to define process capability range; design modifications to meet market, engineering, and production requirements END POINT-Device ready for release to market	24 mos.	200,000	5/24	MSFC
71	Computer Aided Design of Sand Casting Molds	Devise prototype system in conjunction with commercial organization, evaluate on industrial applications END POINT-Define technical limitations & market potential (Army TARADCOM presently anticipating funding 2 yr. comprehensive program @ 400-500K)	12 mos.	75,000	6/26	Johnson
82	Automatic Laser Inspection of Printed Circuit Boards	Build prototype test system & perform qualification test to identify limitations of test process; design modifications to meet market cost requirements & technical position END POINT-Define system and market limitations, release to market	30 mos.	250,000	6/1	MSFC

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(Revision A) 4/11/78

MATEAM PROGRAM RTOP CANDIDATES
1978 FORECAST

(Revision B) 5/15/78

<u>MAT NO.</u>	<u>TITLE</u>	<u>OBJECTIVES</u>	<u>TIME PERIOD</u>	<u>EST. COST (\$)</u>	<u>NEW TECH/ MARKET EVAL. COMPL. DATE</u>	<u>TECH CENTER</u>
105	In Process Technique for Balancing Drive Shafts	Design modifications and testing for specific applications in aircraft engine and automotive industries END POINT-System ready for release to market (Army Funding planned Fiscal Year 1978)	24 mos.	\$100,000	6/30	Lewis

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High Potential Technology Transfer Forecast in Program Year 1978

MILESTONES

GOALS	MONTHS											
	1	2	3	4	5	6	7	8	9	10	11	12
1. <u>MAT-80 Improved Flux for Stud Welding of Aluminum (AQUET)</u>												
a. weld test samples & examine weld joint quality, industrial sources (ex. KSM, Trueweld Co.)												
b. Identify marketing source & industry distribution plan												
(1) Identify major welding accessory distributor (ex. Coordinated Industries, KSM, Unibrazex)												
(2) Review industry marketing plan with selected distributor												
c. Devise technology transfer dissemination plan												
NOTE: NASA FUNDING NOT REQUIRED												
2. <u>MAT-100 High Temp. Plastic Food Processing</u>												
a. Test and evaluation												
b. Presentation of biocompatibility (Acute Toxicity Screening) for FDA approval by Transtherm, Ltd.												
c. Devise technology transfer dissemination plan												
NOTE: NASA FUNDING NOT REQUIRED												

GOALS	MILESTONES											
	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
3. <u>MAT-19 Power Factor Control System</u>												
a. Identify interested industry source (Potential sources - Square "D", Emerson Electric, G.E.)												
b. Identify marketing source & review industry distribution plan												
(1) Select control marketing source (Potential sources - Square D, . Graybar Elec.)												
(2) Review industry marketing plan with source selected in (1) above												
c. NASA RTOP funding approval												
d. Devise technology transfer dissemination plan												
4. <u>MAT-168 Precision Tube Flaring System</u>												
a. Identify magnitude of interest (ex. automotive, aircraft, engines)												
b. Identify manufacturer, marketing source, and review industry market potential												
(1) Select O.E.M. for flaring tool system (ex. Walker Mfg., Skiltool, Milwaukee)												
(2) Identify Marketing source (ex. Sears, Mont. Ward, Bear)												
(3) Review industry marketing plan with source selected in (2)												
c. Devise technology transfer dissemination plan												

GOALS	MILESTONES											
	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
5. <u>MAT-166 The Transfer of Miscellaneous Metallurgical Test Data to Industry</u>												
a. Give MATEam presentation and commence discussions with American Society for Metals (ASM)												
b. Define areas in metallurgical engineering requiring data (cobalt base alloys, chemical etchants, mechanical properties data)												
c. Generate problem/opportunity statements pertaining to technology data deficient areas												
d. Publish under A.S.M. cover valuable metallurgical data												
e. Devise parameters of technology dissemination plan												
NOTE: NASA FUNDING NOT REQUIRED												
6. <u>MAT-167 The Recycling of Painting Process Wash Water for Industrial Applications & Ecological Compatability</u>												
a. Identify problem & industry wide applicability												
b. Perform literature search and contact tech. centers to determine the existence of NASA technology												
c. Perform selected chemical analysis for Kent Corp.												
d. Devise technology transfer dissemination plan.												
NOTE: NASA FUNDING NOT ANTICIPATED AT THIS STAGE												

GOALS	MILESTONES											
	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
7. <u>MAT-152 Flame Resistant Elastomeric Coating</u>												
a. Analyze NASA test results by industrial source												
b. Identify manufacturer, marketing source & industry market potential												
(1) Select chemical solution producer												
(2) Review industry marketing plan with source selected in (1) above												
c. Devise technology transfer dissemination plan												
NOTE: NASA FUNDING NOT REQUIRED												
8. <u>MAT-54 Non-Destructive Testing Spot Welds</u>												
a. Demonstrate Test Device to Industry (Field test at Marshall)												
b. Identify manufacturer, marketing source & industry market potential												
(1) Identify O.E.M. for portable device												
(2) Select marketing source (ex. Branson, Krautkrammer) & review marketing plan												
c. Devise technology trans. plan dissemination												
NOTE: POSSIBLE NASA FUNDING REQUIRED												

GOALS	MILESTONES											
	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
9. <u>MAT-87 Low Intensity Portable X-Ray Device</u>												
a. Demonstrate test device system capabilities to industry at Goddard												
b. Identify manufacturer, marketing source & industry market potential												
(1) Identify O.E.M. for portable device												
(2) Select marketing source (ex. Kodak, GAF, Picker, Magnaflux) and review marketing plan												
c. Devise technology transfer dissemination plan												
NOTE: POSSIBLE NASA FUNDING REQUIRED												
10. <u>MAT-71 Computer Aided Design of Sand Casting Molds</u>												
a. Presentation of capabilities to trade associations (A.S.M., Amer. Foundrymen Soc. & major foundries - Central (GMC), Abex Corp., Blaw-Knox)												
b. Select foundries for demonstration												
c. Field testing at commercial foundry using simplified part design												
d. Identify computer system, marketing source & industry market potential												
(1) Identify computer system manufacturer and language including capability parameters												
(2) Select marketing source and review marketing plan												
e. Devise technology dissemination plan												
NOTE: NASA FUNDING REQUIRED												

POTENTIAL TECHNOLOGY TRANSFERS

<u>No.</u>	<u>Status</u>	
MAT-16	A2U	The Concentration of Waste Heat Recovered from Stack Gas and/or Waste Waters
MAT-22	A3U	Improved Voice Communications in High Noise Level Environment
MAT-28	A3U	Testing Bearings While In Use
MAT-46	A3U	Tool Wear Sensing Using Vibration Analysis
MAT-55	A3U	Non-Contracting 3-D Inspection Probe
MAT-59	A2U	High Quality Nickel Alloy Powder
MAT-72	A3U	Nickel Based X-Ray Film Process
MAT-74	A3U	Controlling the Thickness of Conformal Coating for Printed Circuit Boards
MAT-82	3U	Automatic Laser Inspection of Printed Circuit Boards
MAT-83	A2U	Adhesive bonding of Aluminum
MAT-86	A4C	Adaptively Controlled Weld Skate
MAT-115	A3U	Contingency Planning for Hazardous Environment
MAT-117	A3U	New Cutting Tool Material
MAT-118	A3U	Protective Coating for Die Casting Dies
MAT-131	A3U	Reliable, Economical, Fast Manipulator Arm
MAT-141	A3U	Improved Arc Shield Material
MAT-143	A3U	Single Fill Point Battery Reservoir
MAT-160	A2U	Heat Pipes in Truck Cab Heating
MAT-183	A2U	Oven or Furnace Temperature Measurement Using Telemetry
MAT-190	A1U	Metallurgical Data Related to High Temperature Super Alloys

Enclosure 4

MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
1	High Friction Gasket Material	I2B	Unable to identify NASA technology
2	Measurement of Shrinkage in Textiles	I1D	Inactive - Low potential benefits
3	Humidity Measurement in Air in Textile Ovens	I2B	Unable to identify NASA technology
4	Automatic Equipment for Producing Film Belts	I3F	Likelihood of implementation is low
5	Chemical Etching of Aluminum	A3U	User assessing NASA technology
6	Measuring Fabric Temperature in Ovens	I2B	Unable to identify NASA technology
7	Submerged ARC Welding of Bearing Surfaces on Cast Steel Crankshafts	I2B	Unable to identify NASA technology
8	Natural Gas Filters for Kitchen Ranges	I2H	Not a problem
9	Development of A More Efficient Thermal Cure Process	I2B	No NASA technology
10	Conformal Coating of Printed Circuit Boards	A2U	Gathering all relevant NASA technology
11	Techniques for Measuring Vibration in High Speed Shafts	I1A	Commercial solution available
12	Fabrication of Tubular Stamped Parts	I1C	Problem is unique to company
13	Forming of Titanium Foils	I3H	NASA sent solution
14	Improved Methods for Cleaning and Plating of Cast Iron Cylinder Liners	A2U	Checking all possible sources
15	Controlled Deposition of Fine-Grain Powder onto Fabrics	I2H	No NASA technology
16*	Concentration of Waste Heat Recovered from Stack Gas	A3U	NASA technology being reviewed
17	Flame-Retardant Treatment for Cotton and Polyester Fabrics	A2U	Johnson technical monitor already doing research in related areas
18	Sculpturing of Glass Using Numerical Control	I2B	Unable to identify NASA technology
19**	Power Factor Control System for AC Induction Motors	A4C	Implementation strategy being developed

* Potential technology transfer

**High potential technology transfer

MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
20	Evaluation and Control of Stresses, in Super-Alloys, Resulting from Metal Working Processes	I2D	Inactivated, potential benefits are low
21	Permanent Treatments to Modify Surface Friction of Fibers	I2B	Unable to identify NASA technology
22*	Improved Voice Communications in High Noise Level Environment	I3H	Sent NASA technology
23	Durable Anti-Reflective Treatment for Fabric Surfaces	I2B	Unable to identify NASA technology
24	Recovery of Sand from Shell Molding Process	I2B	Inactivated, no relevant NASA technology
25	High Temperature Binder for Sand Molds	A2U	Gathering data
26	Bonding of Brass to Aluminum	I2A	NASA suggested commercial processes
27	Automated Techniques for Assembling Clock Faces	I1C	Too specialized
28*	Testing Bearings While in Use	A3U	Gathering information
29	Improved Switches for Portable Electric Tools	I2H	No NASA technology
30	Predicting Model for Relating Super-Alloy Microstructure/Properties to Machinability of Isotatically Forged Powder Metallurgy Components	I2B	No NASA technology
31	Evaluation of the Machinability of Scales Resulting from Metalworking Processes	I2H	No NASA technology
32	Metallurgical Variables Affecting the Machinability of Sintered Steel	I2H	No NASA technology
33	Relating Variabilities in Work and Tool Materials to Machining Productivity	I2H	No NASA technology
34	The Role of Inclusions in the Machinability of Commercial Alloys	I2H	No NASA technology
35	Economic Evaluation of Isothermal Forging of Transage Alloys	I2H	No NASA technology
36	Powder Metallurgy Engine Bearings	A2U	Checking NASA sources; Originator to be contacted for more information
37	Automatic Feed System for Hand-Held Bland Rivet Gun	I2B	No NASA technology available

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
38	Inertia Welding	I2A	Inactivated, commercial solutions exist
39	Automated Installation of Both Solid and Blind Rivets, Including Automatic Positioning and Cycle Controls	I2A	Commercial solution available
40	Assembly of Mechanical Devices and Electronic Circuits with Robotics	I2G	Insufficient data
41	Combined Automatic Riveting and Rivet Shaving	I2B	No available NASA technology
42	Optimization and Control of Composite Fabrication Processes	A2U	Currently checking NASA sources
43	Adaptability of Frequency Analysis Techniques to the Optimization of Machine Tool Spindle Power	A2U	Gathering NASA information
44	Fabricated Forging Equivalents	I2B	No relevant NASA technology
45	Direct Linear Control of Machine Tool Slides	A3U	Sent NASA technology
46*	Tool Wear Sensing Using Vibration Analysis	A3U	Gathering information
47	Improved Inspection Accuracy of Machined Components	I2G	Originator not specific enough
48	Protection of NC Equipment Against Power Surges	I1A	Commercial solution available
49	Handbook for Analysis Techniques for Capital Equipment Justification	I2A	Commercial solution available
50	FORTTRAN Translator	I1A	Commercial solution exists
51	Materials Handling of Large Parts in Machining	I2C	Problem too specialized
52	Location of Material in Job Shop	A2U	Gathering information
53	Limited Life Item Management Handbook	A2U	Considering NASA in area for possible publication
54**	Nondestructive Techniques for Spot Weld Testing	A3U	Marshall Space Center contacted about work in area
55*	Non-Contacting 3-D Inspection Probe	A3U	Solution assessment under way, very promising
56	In-Process Inspection and True Position Control of NC Profile Milling Machines	I2G	Insufficient Data

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
57	Ultra High Speed Spindle N/C Multiple Axis Machining Center	I2H	No NASA technology
58	Pulsed Laser Machining	A2U	Lewis Research Center is likely source of solution, promising
59 [*]	Ultraclean, Ultrafine, Rapidly Cooled Nickel Alloy Powder	A2U	Checking NASA sources
60	Nontraditional Machining Guide Books	I1A	Inactivated, commercial solutions exist
61	Reduction of Machining Costs by Valve Engineering Approach	I1A	Commercially available solutions
62	Application of CAM to Organization, Layout, and Sequence of Operations for Machine Tools and Auxiliary Equipment	A2U	Second literature search in progress
63	Integration of Engineering and Manufacturing CAD/CAM Systems	A2U	Second literature search in progress
64	Alternate Materials/Production Process for Fabrication of Microwave Components	I2B	No available NASA technology
65	Diagnostic Testing of N/C Controllers	I2E	Unable to identify acceptable technical solution
66	Air Conditioning for N/C Control Units	I1A	Commercial solution available
67	Material Handling of Precision Components	I1D	Low potential
68	Precision Grinding Techniques	I2B	No NASA technology
69	Precision Surface Finish Inspection Techniques	I2B	No NASA technology
70	Cleaning of Lapped Parts	I2B	Unable to locate NASA technology
71 ^{**}	Computer Aided Design of Die Casting Dies	A4C	Army to fund project
72	Nickel Based X-Ray Film Process	A3U	Contacts with industry in process
73	Friction Reduction Between Contacting Surfaces	A3U	User assessing NASA technology
74 [*]	Controlling the Thickness of Conformal Coatings for Printed Circuit Boards	A3U	Technology being assessed

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
75	Controlling Noise of Sliding or Rolling Equipment	A3U	User assessing NASA technology
76	Improved Method of Cutting Gear Teeth with Emphasis on Lasers	A2U	User will visit a laser site
77	Computer Aided Production Process Planning	A2U	Searching for NASA technology
78	Electro-Mechanical Straightening/Alignment Techniques for Damaged Automobile Frames	A2U	NASA technology possibly identified; originator has offered manpower for development of solution
79	Removal and Replacement of Conformal Coatings	A3U	User assessing NASA solution
80**	Improved Flux for Stud Welding of Aluminum	A6U	Transferred to industry
81	Fabrication of Bi-Metallic Cells	I2A	Commercial solution available
82*	Automatic Laser Inspection of Printed Circuit Boards	A3U	Solution assessment underway
83*	Adhesive Bonding of Aluminum	A2U	Presently compiling information regarding all aspects of NASA work in area
84	Tungsten Inert Gas Welding of Unalloyed Titanium	A2U	Compilation of NASA technology to begin shortly
85	Automatic Assembly and Testing of Electronics	A3U	User assessing NASA technology
86*	Adaptively Controlled Weld Skate	A5U	NASA/CHEMETRON Program
87*	Low-Intensity Portable X-Ray Device	A3U	User assessing NASA technology
88	Recovery and Regeneration of Solvents by Automatic Control	A1U	Problem definition
89	On-Line Analysis of TNT and Intermediate Products	A1U	Problem definition
90	Biological Warning System	I2B	Unable to identify NASA technology
91	Early Warning System to Predict Mechanical Failures	A2U	Gathering information
92	Nondestructive Testing of Cast Explosives	I2B	No NASA technology

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
93	Detection of Surface Flaws Using Laser Holography	A2U	Checking NASA sources
94	Nondestructive Hardness Testing Using X-Ray Diffraction Techniques	A2U	Checking NASA sources
95	Polymer Finishes for Magnesium Alloy Parts	I1C	Problem seems too unique
96	Thermographic Inspection of Optical Bonds	A2U	Gathering information
97	RF Curing of Adhesive Bonded Components	I2B	Unable to identify relevant NASA technology
98	Electromagnetic Forming of Weapon Components	A2U	Information gathering under way; literature survey obtained
99	Bonding of Metal to Ceramic	I3F	NASA techniques found to be unsatisfactory
100**	High Temperature Plastic	A5U	Applications engineering underway by user
101	Co-Deposition of Solid Lubricants During Anodizing	A2U	Promising, probable source for solution is Lewis Research Center
102	Preventing Hydrogen Embrittlement	A1C	Statement preparation complete
103	Co-Deposition of Solid Lubricants During Plating	A2U	Promising, probable source of solution is Lewis Research Center
104	Plasma Arc Assisted Machining	A2U	Promising, probable source of solution is Lewis Research Center
105	In Process Technique for Balancing Drive Shafts	A3U	User assessing NASA technology
106	Inspection of Lamination in Thin Sheet Steel	A2U	Checking NASA sources
107	Stable Thin Film Resistors	I2E	NASA techniques found, so far proved inadequate
108	Reduction of Noise Levels from Portable Handgrinding Operations	A3U	User assessing NASA technology
109	Balancing Drive Shafts Economic Method of Selecting Bearings to Ensure Perfect Fit	A2U	Currently seeking a solution, not promising

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
110	Laser Curing of Resins	A2U	Checking NASA sources; requested more specific information from originator
111	Optical Inspection of Clutch Plates	A2U	Currently seeking a solution, not promising
112	Laser Inspection of Bond Quality of Phenolic Resins	A2U	Checking all NASA sources, need more input from originator
113	Using Lasers to Measure Cure State of Phenolic Resins	A2U	Checking all NASA sources, need further information from originator
114	Use of Cast Iron Components in Oil and Gas Transmission	I1B	No NASA technology available
115 *	Contingency Planning for Hazardous Environments	A3U	User assessing NASA technology
116	Automatic Guidance of Farm Tractors	A2U	Delayed by originator
117	New Cutting Tool Material	A3U	Evaluation tests in progress
118 *	Protective Coatings for Die Casting Dies	A3U	Very promising, solution testing under way
119	Submersed Injection System for Aluminum High Pressure Die Casting	A2U	Currently seeking a solution, promising
120	Programmable Fixturing Devices	A2U	Gathering information
121	Geometric Modeling of Parts	A2U	Gathering information
122	Alternative to Stainless Steel for Use as Food Contact Surfaces	A2U	Information gathering under way, literature search requested
123	Alternatives to Carbon Bearing Rubber as Used in Food Contact Surfaces	A2U	Information gathering under way, literature search requested
124	Alternative Refrigerant to Fluorocarbon	A2U	Checking NASA sources
125	Biodegradable Food Packaging	I1G	Inactivated, insufficient information
126	Cleanliness Testing of Product Contacting Surfaces	A2U	Information gathering under way
127	Synthetic Sweeteners	I1G	Inactivated, insufficient information
128	Substitute for Sugar	I1G	Inactivated, insufficient information

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
151	Automatic NDT for Heavy Weldments	A2U	Identifying NASA technology
152**	Flame Resistant Elastomeric Coating	A3U	Identifying NASA technology
153	Improved High Temperature Material for Troughs in Mineral Furnaces	A3U	User assessing NASA Tech.
154	Lightweight Multifunctional Tools	I3H	User rejected NASA Tech
155	Improved Drive Systems for Hi-Speed Machining Centers	A1U	Problem definition
156	A Tracking and Weld Penetration System	A2U	Identifying NASA technology
157	Control of Noise in Poulit Processing	A2U	Identifying NASA technology
158	Polyester Spinner Temperature Measurement	A1U	Problem Definition
159	Anthropometrics	A1U	Problem Definition
160*	Heat Pipes for Truck Cab Heating	A2U	Assessing Solutions
161	Skeleton Data Base Manager	A1U	Problem Definition
162	Low Cost Vision Systems	A1U	Problem Definition
163	Chrome Sludge Reclamation	A1U	Problem Definition
164	Cheaper 3 GHZ Aerial Construction	A1U	Problem Definition
165	Productivity in Zero G Environment	A3U	User Assessing NASA Tech.
166**	Transfer of Selected Metallurgical Eng. Data to Industry	A1U	Problem Definition
167**	Recycling Paint Wash Water	A2U	Gathering Information
168**	Orbital Tube Flaring Machine	A3U	User Assessing NASA Tech.
169	Advanced Robotics	A1U	Problem Definition
170	Ultra High Speed Machining	A1U	Problem Definition
171	Warm Forging of Ferrous Material	A1U	Problem Definition
172	Forging of Aluminum	A1U	Problem Definition
173	Oxidation of Mercury	A1U	Problem Definition
174	Gelling of Sand Molds	A1U	Problem Definition
175	Removal of Wire Insulation Using Lasers	A1U	Problem Definition
176	Low Cost Servos	A1U	Problem Definition
177	Heat Transfer Techniques for Drying Textiles	A1U	Problem Definition

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MATEAM PROBLEM STATEMENTS AND STATUS

<u>MAT #</u>	<u>TITLE</u>	<u>STATUS</u>	<u>COMMENTS</u>
178	Textile Cleaning During Manufacture	A1U	Problem Definition
179	Industrial Vacuum Cleaning Technology	A1U	Problem Definition
180	Portable Mass Spectrometer	A1U	Problem Definition
181	Tube Weld Inspection Tool	A1U	Problem Definition
182	Gearless Speed Reduction Motor	A1U	Problem Definition
183*	Temperature Measurement Using Telemetry	A1U	Problem Definition
184	Computer Aided Report Translation	A1U	Problem Definition
185	Advanced Metal Working Technology	A1U	Problem Definition
186	Metallurgical Data Related to Ferrous Base Alloys	A1U	Problem Definition
187	Metallurgical Data Related to Aluminum Alloys	A1U	Problem Definition
188	Metallurgical Data Related to Nickel Base Alloys	A1U	Problem Definition
189	Metallurgical Data Related to Cobalt Base Alloys	A1U	Problem Definition
190*	Metallurgical Data Related to High Temperature Super Alloys	A1U	Problem Definition

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SUMMARY OF MATEAM ACTIVITIES

<u>Activity</u>	<u>1977</u>	<u>1st Quarter 1978</u>	<u>Program to date</u>
Industry Presentations	14	9	23
Company Visits	31	4	35
Other Contacts (Phone, Mail, etc.)	467	~ 78	~632
Problems Identified	150	40	190
Problem Statements Prepared	150	30	180
1st Screening Completed	140	10	150
(Problems Failed 1st Screening)	(19)	0	(19)
NASA Technologies Identified	24	10	34
(Problems Failed 2nd Screening)	(22)	(17)	(45)
Solutions Assessed	8	16	24
(Solutions Failed 3rd Screening)	(3)	(3)	(6)
Solution Strategies Developed	4	1	5
(Solutions Failed 4th Screening)	0	0	0
Applications Projects Started	0	1	1
Applications Projects Completed	0	1	1
Implementations Completed	0	1	1
Results Assessed	0	0	0

MANUFACTURING APPLICATIONS TEAM ORGANIZATION

